

# Original Research

## Safety behavior of in-line skaters

**ABSTRACT** ● **Objective and setting** To understand risk-taking behavior and safety practices associated with urban in-line skating, 2,210 outdoor skaters were observed in Boston, Massachusetts. ● **Methods** Estimated age, sex, and use of helmets, wrist guards, and elbow and knee pads were recorded. Skaters were coded as beginner, average, or advanced, and skating locations were classified as street, sidewalk, or bicycle path. ● **Results** About 60% of skaters wore wrist guards, but only 5.7% wore helmets. Male skaters wore less protective equipment than female skaters and were more likely to skate on streets. Beginner and advanced skaters wore more protective gear than average skaters. Surprisingly, street skaters wore less protective gear than skaters on sidewalks or paths. ● **Conclusions** Renewed focus on the importance of wearing helmets is needed. Given the higher injury risks for male skaters, clinicians and public health experts need to target male skaters in prevention efforts. In addition, average and advanced skaters need to be convinced that although they have improved their skills, it is still important to wear protective gear.

As recreational in-line skating grows in popularity, and skating becomes a more common mode of urban transportation,<sup>1,2</sup> injuries and deaths are expected to rise.<sup>2,3</sup> Most skating injuries are from forward falls on outstretched arms,<sup>4</sup> without vehicle, bicycle, or other skater involvement. Most skating-related injuries are preventable if time is taken to learn the basics while skating on flat, smooth, and dry surfaces.<sup>1,4,5</sup> In addition, when falls do occur, regardless of skill level, injuries can be prevented or minimized by wearing appropriate protective gear.<sup>3</sup> Although there are several reports about in-line skating injuries and on recommendations for protective gear, only 3 observational studies describe the use of protective equipment.<sup>6-8</sup> Consequently, we conducted an observational study to understand safety behavior of in-line skaters in Boston, Massachusetts.

### METHODS

One of us (J S O) observed outdoor skaters from July through September 1996 and April to August 1997 at 33 locations in Boston's affluent Back Bay neighborhood. This neighborhood has many professionals, few children, and many college students, especially during the academic year.<sup>9</sup>

Four dichotomous variables record the use of helmets, wrist guards, and elbow and knee pads. The age of skaters is estimated as 12 years and younger, 13 to 17 years, 18 to 50 years, and 51 years and older. Although finer age gradations are typically examined, the goal here is to distinguish between children, teens, adults, and older adults by observation. The wide age categories meet the goal and minimize misclassification errors. Skaters were coded as beginner, average, or advanced. Beginners are easily recognized by their comparative lack of control and poor technique. They lack balance (especially when trying to stand still); flail their arms; fall down occasionally; clutch railings; skate slowly; tend not to stride correctly; and become nervous when confronting bumps, inclines, or other skaters. Advanced skaters appear to be in full control,

sometimes skating backward, doing stunts, or speed skating. They are able to stop quickly and gracefully. Most skaters who could not be classified as beginner or advanced skaters were coded as average.

Skating locations were classified as street, sidewalk, or bicycle path, as has been done in other studies of skate safety.<sup>6</sup> Although this was mainly a study of in-line skaters, because injuries of roller skaters are so similar,<sup>3,4</sup> the 3 observed roller skaters were included. Our exclusion criteria specify that the same skater not be coded twice in the same data collection block or in contiguous data collection blocks at the same location. However, the same skater could be recorded again on the same day.

### RESULTS

Table 1 shows demographic and background data on the sample. Table 2 shows the percentage of skaters wearing helmets (5.7%), elbow (10.0%) and knee pads (22.8%), and wrist guards (60.5%). Female skaters were significantly more likely to wear wrist guards and knee pads. More males than females not only skated with less protective gear, but also were nearly twice as likely as females to skate on streets (13.3% vs 7.6%; table 2).

Table 3 shows the percentage of skaters using the 4 types of protective equipment by skill level. Skaters in the beginner group were significantly more likely to wear all 4 types of gear. The use of helmets, elbow pads, and knee pads dropped for average skaters and then increased for advanced skaters. The use of wrist guards was highest among beginners, then declined for average skaters, and declined further for advanced skaters.

In table 4, the 4 types of protective gear are considered together. The 2 largest categories comprise skaters who wore no protective gear (n = 824) and those who wore only 1 type of gear (n = 839); 539 skaters wore 2 to 4 types of gear. Only independent variables that were significantly related to the use of protective gear are depicted in the table. Female skaters, skaters aged 12 years or younger,

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those aged 50 years and older, beginners, and skaters on bicycle paths wore the most protective gear.

Not shown in the tables is that among street skaters, none were in the beginner category, compared with 9.2% beginners on sidewalks and 8.7% beginners on bicycle paths ( $P < 0.001$ ). The use of protective gear was not significantly related to a weekday or the weekend, the number of passing skaters per hour, ambient temperature, or the month of observation.

## DISCUSSION

Males are at higher risk for all types of injuries,<sup>10</sup> including skating-related injuries.<sup>4,5</sup> According to Ellis et al, "Approximately twice as many boys as girls were injured in sports-related activities as compared to a 4 to 1 ratio in in-line skating."<sup>5</sup> Schieber and Branche-Dorsey hypothesized that this may be due to more males skating than



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Wearing protective gear while skating would reduce the number and severity of injuries

Table 1 Demographic and background information on 2,210 in-line skaters

Variable	Skaters, no. (%)
Sex	
Male	1,516 (68.6)
Female	694 (31.4)
Age, yr	
≤12	35 (1.6)
13-17	106 (4.8)
18-50	2,038 (92.2)
≥51	31 (1.4)
Skill*	
Beginner	171 (7.7)
Average	1,860 (84.2)
Advanced	177 (8.0)
Weekday	
Yes	892 (40.4)
No	1,318 (59.6)
Ambient temperature, °C (°F)	
21 (<70)	585 (27.5)
21 to 26 (70-79)	890 (41.9)
≥27 (≥80)	650 (30.6)
Location	
Street	255 (11.5)
Sidewalk	337 (15.2)
Bike path	1,618 (73.2)

\*Skill level was not assessed for 2 skaters.

†In 85 cases, the ambient temperature was not recorded.

females, lesser ability of males, or more risky behavior among males.<sup>4</sup>

Our data support 2 of these 3 explanations. In Boston, more male skaters would be expected to be injured because males comprise about 70% of skaters and they take greater risks. Not only do they wear less protective equipment, they are also more likely to skate on streets with traffic. Our data do not support the notion, however, that more male skaters are injured because they are less skilled.

There is some evidence that beginners are at higher risk for sustaining skating-related injuries. In their case series of 57 injured skaters in New York and Chicago, Callé and Eaton report that 34 (60%) were novice skaters and 17 (30%) were intermediate skaters.<sup>3</sup> Similar findings have been reported for roller skaters.<sup>11,12</sup> However, a recent study claims that advanced skaters are at higher risk of injury.<sup>13</sup> More experienced skaters tend to skate at more dangerous locations such as on the street, perform tricks, and skate more hours, making them more prone to injury than novice skaters. The conventional wisdom that novice skaters are at higher risk of injury may be a dangerous myth encouraging skaters to stop wearing protective equipment when they become more proficient.

We observed 2,210 skaters in 1 section of Boston in 1996 and 1997. Percentages of skaters wearing various types of protective gear would likely differ in other cities,

Table 2 Protective gear use and skating location by sex

Variable	Male	Skaters, % Female	Total
Using gear			
Helmet	5.6	5.9	5.7
Elbow pads	9.3	11.4	10.0
Knee pads*	20.1	28.6	22.8
Wrist guards*	54.7	73.2	60.5
Skating location*			
Street	13.3	7.6	11.5
Sidewalk	15.4	14.8	15.2
Bike path	71.2	77.5	73.2

\* $P < 0.001$ .

as would the percentage wearing gear in Boston over time. Generalizability is limited given the geographic and time-bound nature of these data.

### IMPLICATIONS FOR PREVENTION

The low percentage of skaters observed wearing helmets (5.7%) is appalling. Two articles by Schieber and colleagues focus on head injury.<sup>4,14</sup> Although the incidence of head injury is much lower than other types of skating injuries, head injuries can result in serious long-term disabilities. It is important to dispel popular myths that helmets are uncomfortable, unnecessary at certain times (for example, when skating on paths away from motorists), or unnecessary for certain individuals (for example, experienced skaters).

According to our data, young male skaters are at highest risk of skating-related injuries because they skate more, are more likely to skate in dangerous locations, and wear less protective gear than female skaters. Given the higher risks for males, clinicians and public health experts need to target males for prevention efforts. Convincing male skaters to follow the “rules of the road” and to wear protective gear would reduce the number and severity of injuries.

Along with males, moderately skilled and expert skaters should also be targeted for injury prevention efforts. These data show that moderately skilled skaters are less likely to

Table 3 Percentage of skaters using protective gear by skill level

Gear type	Beginner (n = 171)	Average (n = 1,850)	Advanced (n = 177)
Helmet	10.5	5.1	7.3*
Elbow pads	22.2	8.3	15.8†
Knee pads	39.2	21.1	24.9†
Wrist	74.3	60.1	52.0†

\* $P < 0.01$ .† $P < 0.001$ .

Table 4 Significant predictors of use of skate protective gear\*†

Variable	None (n = 824)	Gear use, % 1 Type (n = 839)	2-4 Types (n = 539)
Sex			
Female	25.4	44.0	30.6
Male	43.1	35.3	21.6
Total	37.5	38.0	24.4
Age, yr			
≤12	28.6	17.1	54.3
13 to 17	63.2	20.8	16.0
18 to 50	36.5	39.5	24.0
≥50	25.8	22.6	51.6
Total	37.5	38.0	24.4
Skill			
Beginner	22.8	35.1	42.1
Average	38.1	39.2	22.7
Advanced	45.2	28.8	26.0
Total	37.4	38.1	24.5
Location			
Street	52.2	28.2	19.6
Sidewalk	40.9	34.4	24.6
Path	34.5	40.4	25.2
Total	37.5	38.0	24.4

\*All cells have expected frequencies &gt;5.

† $P < 0.001$ .

wear protective gear than either beginning or advanced skaters. Motivating these average skaters to emulate more safety-conscious advanced skaters would be a major public health accomplishment. Convincing average and expert skaters to always wear all the gear would prevent many head and extremity injuries.

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